

REMARKS/ARGUMENTS

Claims 1, 2 and 4 are pending. By this Amendment, claim 3 is cancelled, and claims 1 and 4 are amended. Support for the amendments to claims 1 and 4 can be found, for example, in the present specification at page 7, lines 10 to 12 and page 10, lines 14 to 15, and in original claims 1-4. No new matter is added. In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

Objection to the Claims

The Office Action objects to claim 4 as being an improper multiple dependent claim. By this Amendment, claim 4 is amended to obviate the objection. Accordingly, reconsideration and withdrawal of the objection are respectfully requested.

Rejection Under 35 U.S.C. §112, First Paragraph

The Office Action rejects claim 1 under the enablement requirement of 35 U.S.C. §112, first paragraph. Applicants respectfully traverse the rejection.

The Office Action asserts that claim 1 is not enabled because the "Karl Fisher method" is not defined in the present specification. Applicants submit that one of ordinary skill in the art would readily understand what the "Karl Fisher method" is, and how the "Karl Fisher method" is practiced in order to determine the water content of a particular material (an α -olefin in this case). Applicants have attached publication "AQUASTAR: Karl Fischer Titration Basics," EMD Chemicals, Inc. (copy attached), which illustrates how both the "Karl Fisher method" is practiced and that the "Karl Fisher method" is well-known to those of ordinary skill in the art. A skilled artisan could practice the method of claim 1 without undue experimentation. See MPEP §2164.01.

For the foregoing reasons, claim 1 is fully enabled. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Rejection Under 35 U.S.C. §103

The Office Action rejects claims 1-4 under 35 U.S.C. §103(a) over U.S. Patent No. 6,054,629 to Baralt et al. ("Baralt") in view of U.S. Patent No. 4,879,429 to Suzukamo et al. ("Suzukamo"). By this Amendment, claim 3 is cancelled, rendering the rejection moot as to that claim. As to the remaining claims, Applicants respectfully traverse the rejection.

Claim 1 recites "[a] method for producing a linear internal olefin, comprising: contacting an α -olefin with a zeolite catalyst and/or a montmorillonite catalyst to isomerize the α -olefin and obtain the linear internal olefin; wherein: the α -olefin contains 50 ppm water or less according to the Karl Fischer test method; and contacting the α -olefin with the zeolite catalyst and/or the montmorillonite catalyst comprises contacting at a reaction temperature of from 140 to 180°C" (emphasis added). Baralt and Suzukamo do not disclose or suggest such a method.

The Office Action asserts that Baralt discloses performing isomerization by contacting α -olefins with a zeolite catalyst at temperatures of from 140 to 180°C. *See* Office Action, page 3. The Office Action concedes that Baralt does not disclose drying the α -olefins, but asserts that it would have been obvious to dry the α -olefins in view of Suzukamo's disclosure of a method of producing an internal olefin in which the feed olefin is treated with a drying agent. *See* Office Action, page 3. Notwithstanding these assertions, Baralt and Suzukamo would not have rendered obvious claim 1.

At the outset, neither Baralt nor Suzukamo discloses or suggests employing an α -olefin containing 50 ppm water or less in a reaction to obtain internal linear olefins. Baralt does not disclose drying at all, and Suzukamo includes only a general indication that a feed

material should be treated with a drying agent. *See Suzukamo*, column 4, lines 58 to 59. Further, the methods of Baralt and Suzukamo involve entirely different reaction conditions that are not apparently compatible. For example, Baralt discloses using a pentasil zeolite catalyst at a temperature of from 100 to 250°C (*see Baralt*, claims 1 to 5), while Suzukamo discloses using a solid base catalyst at a temperature of from -10 to 100°C (*see Suzukamo*, column 4, lines 42 to 50). In view of these vast differences in reaction conditions, one of ordinary skill in the art would not expect that the drying described in Suzukamo would have any applicability to the method of Baralt.

For the reasons discussed above, a *prima facie* case of obviousness has not been made. However, even if a *prima facie* case were made, such case is rebutted by the results shown in the present specification – "[a] *prima facie* case of obviousness ... is rebuttable by proof that the claimed compounds possess unexpectedly advantageous or superior properties." *See* MPEP §2144.09 (citing *In re Papesch*, 315 F.2d 381 (C.C.P.A. 1963)). The Examples of the present specification demonstrate that a method for producing a linear internal olefin in which an α -olefin containing 50 ppm water or less is contacted with a zeolite catalyst and/or a montmorillonite catalyst at a reaction temperature of from 140 to 180°C, such as recited in claim 1, provides a superior yield of linear internal olefins (87.4%) relative to known methods in which, e.g., an α -olefin containing more than 50 ppm water is employed. *See, e.g.*, present specification, page 11, Table 1. These results are objective evidence of the improvements of the method of claim 1 over known methods as in Baralt, and thus these results rebut any suggestion that it would have been obvious to modify the method of Baralt in view of the teachings of Suzukamo.

As neither Baralt nor Suzukamo discloses or suggests a method for producing a linear internal olefin in which an α -olefin containing 50 ppm water or less is contacted with a zeolite catalyst and/or a montmorillonite catalyst at a reaction temperature of from 140 to

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180°C, the combination of references fails to disclose or suggest each and every feature of claim 1.

As explained, claim 1 would not have been rendered obvious by Baralt and Suzukamo. Claims 2 and 4 depend from claim 1 and, thus, also would not have been rendered obvious by Baralt and Suzukamo. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Conclusion

For the foregoing reasons, Applicants submit that claims 1, 2 and 4 are in condition for allowance. Prompt reconsideration and allowance are respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Norman F. Oblon

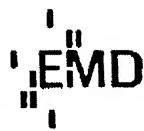
Jacob A. Doughty
Registration No. 46,671

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/07)

Attachment:

Copy of "AQUASTAR: Karl Fischer Titration Basics," EMD Chemicals, Inc.



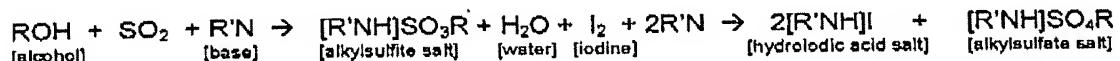
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Karl Fischer Titration Basics

What is Karl Fischer Titration?

Karl Fischer titration is a widely used analytical method for quantifying water content in a variety of products. The fundamental principle behind it is based on the Bunsen Reaction between iodine and sulfur dioxide in an aqueous medium. Karl Fischer discovered that this reaction could be modified to be used for the determination of water in a non-aqueous system containing an excess of sulfur dioxide. He used a primary alcohol (methanol) as the solvent, and a base (pyridine) as the buffering agent.

What is the Karl Fischer Reaction?



The alcohol reacts with sulfur dioxide (SO_2) and base to form an intermediate alkylsulfite salt, which is then oxidized by iodine to an alkylsulfate salt. This oxidation reaction consumes water.

The reactive alcohol is typically methanol or 2-(2-Ethoxyethoxy)ethanol, also known as diethylene glycol monoethyl ether (DEGEE), or another suitable alcohol.

Classic Karl Fisher reagents contained pyridine, a noxious carcinogen, as the base. The reagents most frequently used today are pyridine-free and contain imidazole or primary amines instead.

How does it work?

Water and iodine are consumed in a 1:1 ratio in the above reaction. Once all of the water present is consumed, the presence of excess iodine is detected voltammetrically by the titrator's indicator electrode. That signals the end-point of the titration.

The amount of water present in the sample is calculated based on the concentration of iodine in the Karl Fisher titrating reagent (i.e., titer) and the amount of Karl Fisher Reagent consumed in the titration.

EMD Chemicals Inc.
460 South Democrat Road
Gibbstown, NJ 08027

Phone: 856-423-6300
Fax: 856-423-4389
www.emdchemicals.com

Is the Karl Fischer Reaction sensitive to pH?

The rate of the reaction depends on the pH value of the solvent, or working medium. When pH is between 5 and 8, the titration proceeds normally. However, when the pH is lower than 5, the titration speed is very slow. On the other hand, when pH higher is than 8, titration rate is fast, but only due to an interfering esterification side reaction which produces water, resulting in an vanishing endpoint. Thus, the optimal pH range for the Karl Fischer reaction is from 5 to 8, and highly acidic or basic samples need to be buffered to bring the overall pH into that range.

What are the two types of Karl Fischer Titration?

1) Volumetric KFT

In volumetric Karl Fischer, iodine is added mechanically to a solvent containing the sample by the titrator's burette during the titration. Water is quantified on the basis of the volume of Karl Fischer reagent consumed.

Volumetry is best suited for determination of water content in the range of 100 ppm to 100%.

There are two main types of volumetric KFT reagent systems:

- a) In one-component volumetric KF, the titrating reagent (also known as a CombiTitrant, or a Composite) contains all of the chemicals needed for the Karl Fischer Reaction, namely iodine, sulfur dioxide, and the base, dissolved in a suitable alcohol. Methanol is typically used as the working medium in the titration cell. One-component volumetric reagents are easier to handle, and are usually less expensive than two-component reagents.
- b) In two-component volumetric KF, the titrating agent (usually known as the Titrant) contains only iodine and methanol, while the Solvent containing the other Karl Fischer Reaction components is used as the working medium in the titration cell. Two-component reagents have better long-term stability and faster titration times than one-component reagents, but are usually more costly, and have lower solvent capacity.

2) Coulometric KFT

In coulometric Karl Fischer, iodine is generated electrochemically *in situ* during the titration. Water is quantified on the basis of the total charge passed (Q), as measured by current (amperes) and time (seconds), according to the following relationship:

$$Q = 1 \text{ C (Coulomb)} = 1 \text{ A} \times 1 \text{ s} \quad \text{where} \quad 1 \text{ mg H}_2\text{O} = 10.72 \text{ C}$$

Coulometry is best suited for determination of water content in the range of 1 ppm to 5%.

There are two main types of coulometric KFT reagent systems:

- a) In conventional, or fritted-cell, coulometric KF, a diaphragm – or frit – separates the anode from the cathode that form the electrolytic cell known as the generator electrode.

The purpose of the frit is to prevent the iodine generated at the anode from being reduced back to iodide at the cathode instead of reacting with water.

b) In *fritless-cell* coulometric KF, an innovative cell design is used that through a combination of factors, but without a frit, makes it nearly impossible for iodine to reach the cathode and get reduced to iodide instead of reacting with water.

The advantages of the fritless cell (cell without a diaphragm) include:

- Uses only one reagent
 - Lower reagent cost
- Titration cell much easier to clean
 - Reduced downtime
 - Lower maintenance cost
- Long-term drift (background) value more stable
 - Can use reagent longer without refilling
- Refilling of electrolyte suitable for automation
 - Reduced downtime
 - Increased lab safety

How does a Volumetric Titrator work?

The volumetric titrator performs the following three key functions:

- 1) It dispenses KF titrating reagent containing iodine into the cell using the burette
- 2) It detects the endpoint of the titration using the double platinum pin indicator electrode
- 3) It calculates the end result based on the volume of KF reagent dispensed using the on-board microprocessor

How does a Coulometric Titrator work?

The titrator performs the following three key functions:

- 1) It generates iodine at the anode of the titration cell, instead of dispensing KF reagent as in volumetric titration
- 2) It detects the endpoint of the titration using the double platinum pin indicator electrode
- 3) It calculates the end result based on the total charge passed (Q), in Coulombs, using the on-board microprocessor

How can Titrator performance be monitored?

The use of specially formulated NIST traceable water standards, provided in sealed single-use ampoules, enables efficient monitoring of titrator performance. Additionally, in volumetry, and

when performing Karl Fischer titrations using an oven or solid evaporator, solid standards may also be used.

Standard	Cat. No.	Form	Application(s)
Water Standard Oil 15-30ppm NIST	1.88055	liquid	Coulometry of oils, Oil Evaporators
Water Standard 0.01% NIST	1.88050	liquid	Coulometry
Water Standard 0.1% NIST	1.88051	liquid	Coulometry, Volumetry
Water Standard 1.0% NIST	1.88052	liquid	Coulometry, Volumetry
Water Standard 5mg/ml	1.09259	liquid	Volumetry
Water Standard Oven 1%	1.88054	solid	KF Ovens
Lactose Standard 5%	1.12939	solid	Coulometry, Volumetry, KF Ovens
Sodium Tartrate Dihydrate 15.66%	1.06664	solid	Volumetry

What sample size should be used?

The amount of sample used depends on the anticipated water content and the desired degree of accuracy. Please refer to the following convenient reference table:

SAMPLE WATER CONTENT	VOLUMETRIC SAMPLE SIZE	COULOMETRIC SAMPLE SIZE
100%	0.02 to 0.05 g	NOT RECOMMENDED
50%	0.05 to 0.25 g	0.01 g
10% (100,000 PPM)	0.25 to 0.50 g	0.01 to 0.05 g
5% (50,000 PPM)	0.50 to 2.50 g	0.05 to 0.10 g
1% (10,000 PPM)	2.50 to 5.00 g	0.10 to 0.50 g
0.5% (5,000 PPM)	5.00 to 7.50 g	0.20 to 1.00 g
0.1% (1,000 PPM)	7.50 to 10.0 g	1.00 to 2.00 g
0.01% (100 PPM)	10.0 to 15.0 g	2.00 to 5.00 g
0.001 (10 PPM)	15.0 to 20.0 g	5.00 to 10.0 g
0.0001% (1 PPM)	NOT RECOMMENDED	10.0 g OR MORE